



Review of Critical Factors Related to Employment After Spinal Cord Injury: Implications for Research and Vocational Services

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Received January 15, 2009; accepted April 6, 2009

Abstract

Background/Objective: Employment rates after spinal cord injury (SCI) vary widely because of discrepancies in studies' definition of employment and time of measurement. The objective of this study was to provide a comprehensive summary of the literature on employment rates, predictors of employment, and the benefits and barriers involved.

Methods: A search using the terms spinal cord injury and employment in the databases PubMed, PsycINFO, and MEDLINE. The search included a review of published manuscripts from 1978 through 2008.

Results: A total of 579 articles were found and reviewed to determine the presence of reported employment rates. Of these, 60 articles were found to include a report of employment rates for individuals with SCI. Results indicated that, in studies that examined paid employment, the average rate of any employment after SCI was approximately 35%.

Conclusions: Characteristics associated with employment after SCI include demographic variables, injury-related factors, employment history, psychosocial issues, and disability benefit status. It is recommended that researchers studying employment after SCI use common outcome measures such as competitive employment rates, duration of employment, and job tenure. Empirical evidence is lacking in regard to the most effective methods of vocational rehabilitation among this population. Evidence-based supported employment practices seem to be the most applicable model for assisting persons with SCI in restoring meaningful employment. Controlled studies are needed to test this assumption.

J Spinal Cord Med. November 2009;32(5):503–531

Key Words: Evidence-based practice; Employment; Supported employment; Disabilities; Spinal cord injuries; Tetraplegia; Paraplegia; Veterans; Vocational rehabilitation

INTRODUCTION

According to the National Spinal Cord Injury Statistical Center (NSCISC), it is estimated that there are 12,000 new cases of spinal cord injury (SCI) every year in the United States. Approximately 60% of cases occurred in people 16 to 30 years of age, corresponding to the developmental periods associated with career development and establishment (1). Average age at injury was 39.5 years, and more than one half (57.4%) were employed at the time of their injury. Ten years after

injury, 32.4% of persons with paraplegia were employed, whereas only 24.2% of those with tetraplegia were employed at that time. Compared with the general population, unemployment rates in the SCI population have been reported in excess of 10-fold. It has been estimated that only 12% of individuals with SCI return to their preinjury jobs (2). According to polls of unemployed persons with disabilities, 79% report that they want to work, and recent data suggest many persons with SCI who are currently unemployed judge themselves to be capable of working (3) and express a desire to work (4).

Unemployment remains a prevalent and serious problem for persons with SCI, which is especially disturbing in light of evidence that vocational outcomes affect both quality of life and longevity (5–7). Low employment rates after rehabilitation are cause for concern since return to gainful employment may be the most recognized primary marker of successful

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This study was supported by VA Rehabilitation Research & Development Grant B3773R.

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rehabilitation outcome after disability (8). Thus, the aim of this review is to examine the literature regarding the effect of SCI on employment characteristics such as rates of employment, characteristics associated with obtaining and sustaining employment, and benefits and barriers associated with work after SCI. The literature search was conducted using the terms spinal cord injury (SCI) and employment in the databases PubMed, PsycINFO, and MEDLINE. This search included a review of published manuscripts dating back 30 years (1978–2008). Available vocational services for SCI are reviewed and implications for future research and practice are discussed. Information related to veterans, who comprise almost one fifth of current SCI cases in the United States, are also reviewed.

SCI AND VOCATIONAL OUTCOMES

Rates of Employment After SCI

Of the studies reviewed that included employment rates in individuals with SCI, rates varied from 3% to 80%. Such a wide range in rates may be attributable to factors such as sample characteristics, method of obtaining data, definition of employment used, and time since injury (Table 1). Of the studies reviewed that reported participant age at the time of study, the mean age of participants ranged from 25.3 to 53.8 years. Although not consistently indicated, age at time of injury ranged from childhood to 30 years. However, in many cases the mean age of the respondents reported was not specified to indicate whether it was the age of the respondent at time of injury or time of participation in the related study. Also, the amount of time that passed since SCI has not always been reported by researchers. In the studies reviewed that reported this variable, time since injury varied from 2 to 25 years. Rates of employment between studies can only be meaningfully compared if the samples involved in the particular studies are equivalent in regards to key participant characteristics. However, as seen in Table 1, study participants greatly varied in such key characteristics as age, time since injury, and level of injury.

Employment rates show significant variation depending on the definition of employment used. The definition of employment, when described, seems to substantially vary among studies. For example, employment was described in some studies as “working for pay” (8), “working for a living: (9), “employed or actively looking for work” (10), and “performance of significant, productive physical or mental work for pay or profit” (11). Furthermore, some researchers divided their samples into groups that included homemakers and students (5,12). Instead of focusing solely on a dichotomous indicator of vocational status (eg, employed vs unemployed), some researchers (5,12,13) used multiple status variables for classifying employment status, such as “employed,” “gainfully employed,” “unpaid productive” (including volunteers, students, and homemakers), and “unemployed.” Using such a classification system to describe

vocational outcomes of persons with SCI warrants consideration for use in future studies to generalize classification groups among research studies. Currently, the significant variations in definitions used by researchers make it difficult to interpret the meaning of employment rates across studies that use differential definitions. Even more concerning is the fact that no definition of employment was given in nearly one half of the studies reviewed.

Related to definition of employment is the time frame used for capturing employment status. For example, some researchers have defined being employed as working at the time of the study (14–17), whereas others used other time frames such as being employed within 6 months of the study (18) or any time after SCI injury (2,19–21). If vocational status is solely based on current status at time of the interview, it only allows for a snapshot of the person’s employment history. For example, Castle (22) reported that in addition to the 31% who were employed at the time of the survey, 4% had been employed since injury but unemployed at the time of the study. In addition, cumulative employment over time can result in a distorted picture of vocational status because it may include individuals who have limited vocational success as having positive outcomes (eg, someone who has worked for only a few months during the past 2 years would be counted in the employed group). In other words, measuring employment cumulatively over time may artificially increase the likelihood of reporting successful vocational outcomes. For example, in a study that had an average time since injury of 18.6 years (20,21), the participants had a significant amount of time to return to work, likely influencing the higher employment rate (48%) found in comparison to that reported in previous studies that found lower employment rates among persons with tetraplegia within a few years of being injured. Using current employment status allows for comparison with conventional indices of employment status such as the employment rate for the general population. Examining current employment rates and employment history in conjunction with each other may be more beneficial than looking at either alone.

An additional factor to consider is that researchers often do not indicate the percentage of subjects who were employed at the time of their SCI. Research indicates that employment rates dramatically decrease when comparing preinjury to postinjury vocational status (23). If a person was not employed at the time of their SCI, comparing their employment rate after SCI with someone who was employed at the time of their SCI is not optimal. In other words, expecting someone who is unemployed before injury to become employed after a tragic injury is different than expecting an employed person to continue being employed after an injury. Also, it has been shown that those individuals with SCI who return to former jobs do so much earlier than those who

are seeking new employment (22,24). Thus, assessing employment history before injury, at time of injury, and after injury may be important to provide the best descriptive employment picture to maximize one's ability to generalize study findings. Krause (24) has used classification systems where unemployed participants have been categorized into groups based on whether they had worked at any time since injury (24). He classified participants into 4 groups based on a cross-tabulation of employment status at the 2 times of measurement after injury: (a) employed on both occasions, unemployment (stable employment), (b) employed at time 1 but unemployed at time 2 (negative transition), (c) unemployed at time 1 but employed at time 2 (positive transition), and (d) unemployed on both occasions (chronic unemployment) (25). Extrapolating this classification system to include employment status at time of injury and then at different data points after injury may be most beneficial in capturing the potential effects of employment history on current employment status and associated outcomes.

Employment rates can be adversely affected by external incentives, such as compensation and availability of government support for postinjury employment. For example, an unemployment rate of 80% was found among veterans rehabilitated in a Boston VA facility (26). However, it should be noted that 63% of the sample reportedly received nonservice-connected VA benefits, which suggests that they could lose benefits if they became employed. In a study by Siosteen et al (27) of SCI in Sweden, a 70% employment rate was found, which may be attributable to the extent to which government legislation in Sweden facilitates providing assistance to even those with severe SCIs to earn an income. Alternatively, compensation for injuries related to SCI may adversely affect employment outcomes. For example, in a study of patients with SCI in Australia, 52% of the sample received entitlements to third-party compensation as the result of their injury, which likely influenced the 26% employment rate reported (10). Overall, it is difficult to quantify the nature and impact of financial disincentives to employment because of the variability of federal and state benefit systems within the United States, as well as in other countries.

With a few exceptions (14,22,28,29), most studies do not indicate what type of employment positions are obtained after SCI, although some researchers have indicated that a small percent of individuals return to their preinjury jobs (14,30). It has been reported that, among those who return to work, more individuals enter into new occupations than return to preinjury jobs (22). Although a few studies have indicated that common occupations obtained by individuals with SCI include office, finance, clerical, administrative, technical, and professional jobs (22,31,32), it is rare for researchers to report what type of positions are obtained after injury

and whether there is a significant difference from that of preinjury occupation.

Since 2005, motor vehicle crashes have accounted for 42% of reported SCI cases (33). Given that motor vehicle accidents account for almost one half of the traumatic brain injuries (TBIs) in the United States (34), it would be expected that a great number of individuals with SCI may have suffered head injuries and subsequent cognitive impairment. In fact, there is a high rate of comorbidity between TBI and SCI, and it has been suggested that TBI accompanies SCI more often than once thought (35–37). However, it is the rare exception (27) that researchers address whether subjects suffered head injuries and/or accompanying cognitive impairments. Cognitive impairment is related to worse employment outcomes and more intensive vocational services for persons receiving supported employment (38,39). For example, for those persons diagnosed with mental illness and cognitive impairments, those with cognitive impairments receive more supported employment services per hour of competitive work (38). Given that supported employment specialists can assist their clients with specific strategies for coping with cognitive impairment (40), it would seem important to identify those persons with SCI who also have cognitive impairment as the result of their injury.

In studies involving individuals with SCI seeking employment, it is very rare for the mental health of research participants to be addressed, which is unfortunate given that mental health conditions such as depression and anxiety can negatively affect motivation and energy levels. Siosteen et al (27), for example, showed that return to work after SCI was not only impacted by physical status but also emotional status and quality of life. Some researchers have concluded that psychologic variables, such as locus of control, personality variables, and work attitude, significantly impact returning to work after spinal cord injury (15,16). Subjective variables, such as satisfaction level, have been identified as being related to working after SCI. For example, Decker and Schulz (41) found that being satisfied with life was significantly positively correlated with being employed, whereas income only showed a slight positive correlation. In other words, regardless of the level of financial remuneration, employment may have a positive influence on life satisfaction. Optimism, self-esteem, achievement orientation, and work ethic have also found to be associated with obtaining employment after SCI (28,42). Having positive expectations has also been shown to be related to successful vocation reintegration and higher employment rates (17,29). In a matched sample of employed and unemployed individuals with SCI, the employed individuals tended to view work as enhancing self-esteem, described more positive role model experiences, were more optimistic, reported positive coping, and reported increased motivation (42).

Table 1. Rates of Employment in SCI studies

Study/Location	Sample Characteristics	Method of Obtaining Data	Definition of Employment	Employment Rate
Alfred et al (1987) United States	33 patients with SCI 16 paraplegia, 17 tetraplegia Age range 18–42 years Mean age = 25.3 years Mean length of education = 11.9 years	Semistructured interviews; first was in-person while most follow-ups were by telephone	Vocationally active as defined as those in competitive employment, active job placement status, or in training programs	64% vocationally active 2 years after discharge
Anderson and Vogel (2002) United States and Canada	195 individuals enrolled in SCI programs who sustained an SCI by age 18 years and did not have a significant brain injury 69% male 62% white; mean age at injury = 14 years Mean age at interview = 29 years Mean duration of injury = 15 years	Structured interview by telephone	Employed at least 1 h/wk	51%
Anderson et al (2004) United States and Canada	265 individuals who sustained SCI at age ≤ 18 years, were ≥ 24 years of age at interview, and did not have significant brain injury 67% male 87% white 32% college degree Mean age at injury = 13.9 years Mean age at interview = 27.8 years 59% tetraplegia	Structured interview by telephone	Excluding students and homemakers	57% employed at least part-time
Anderson et al (2006) United States and Canada	166 individuals who sustained SCI at ≤ 18 years of age, were ≥ 24 years of age at interview, and did not have significant brain injury 69% male 92% white Mean age at injury = 14.2 years 64% tetraplegia	Structured interview by telephone annually for 3 years	Employed either full-time or part-time (excluding students and homemakers)	64% employed at first interview; 83% of those employed at year 1 continued to be employed at year 3
Athanasou et al (1996) Australia	139 persons in Australia with SCI 117 men, 22 women Mean age = 43.5 years 25% complete tetraplegia 26% incomplete tetraplegia 27% complete paraplegia 22% incomplete paraplegia Time since injury: <1 to 43 years	Survey questionnaire	Not defined	22% full-time work 9% part-time work 6% voluntary work 6% student 8% domestic duties (31% were engaged in either part-time or full-time work)

Table 1. Continued

Study/Location	Sample Characteristics	Method of Obtaining Data	Definition of Employment	Employment Rate
Benavente et al (2003) Spain	90 patients admitted over a 1-year period to a hospital in Spain. Individuals were assessed 5 years after injury 72% male 48% thoracic 76% traumatic cause Mean age at time of injury = 33.7 years	Mailed questionnaire	Paid job	12.40%
Boschen et al (2003) Canada	100 community-residing individuals who were between 1 to 5 years post-discharge active rehabilitation. 75% male Mean age = 40 years 43% single 58% tetraplegia	Structured interview and focus group	Used the DeJong's Productivity Status Ranking Chart to categorize sample into productivity categories.	36%
Castle (1994) United Kingdom	114 persons with traumatic SCI who received treatment at a spinal treatment center in Salisbury and followed 1–7 years after injury 82% male 10% high tetraplegia 16% tetraplegia 45% paraplegia 29% incomplete lesions	Mailed questionnaire	Paid employment	31%
Cook et al (1981) United States	144 rehabilitation clients with SCI served by the Arkansas Rehabilitation Service from July 1, 1975 to June 30, 1978 73% male 80% white Median age = 30 years 47% HS education Median age of injury = 22 years Age range = 15–71 years	Structured interview form for initial interview by vocational rehabilitation counselor; follow-up questionnaires were mailed	Not defined	23% working for wages/salaries or were self-employed 16% were homemakers or unpaid family workers 11% were students
Crewe (2000) United States	50 individuals who had received services from the Renal Function Clinic at University Hospitals in Minnesota 86% male Mean education = 14.58 years Duration of injury: 23–45 years Median age = 47 years 62% tetraplegia	Mailed questionnaire (LSQ). Data were collected in 1974 and again in 1994	Not defined	56% employed fulltime in 1994; 72% were employed part-time or full-time in 1994 86% held paying jobs at some time after their SCI

Table 1. Continued

Study/Location	Sample Characteristics	Method of Obtaining Data	Definition of Employment	Employment Rate
Crewe and Krause (1990) United States	154 individuals who had received services from the Renal Function Clinic at University Hospitals in Minnesota and who had sustained a traumatic SCI at least 2 years before initial assessment 81% male 49% married Mean age in 1974 = 32 years; Mean age in 1985 = 43 years	Mailed questionnaire in 1974 and 1985	“Employed” vs “Not employed for pay”	51% employed at follow-up, at least 13 years after injury
Crisp (1981) Australia	97 persons who had been referred over a 3-year period to a vocational counselor at a SCI facility in Australia 54% paraplegia 91% male Mean age = 29.5 years	Telephone or personal interview	Not defined	40%
Cushman and Hasset (1992) United States	43 persons with SCI who had been injured 10 to 15 years previously and had completed a stay on a local inpatient rehabilitation unit at that time Mean age at time of injury = 34.2 years 72% males 37% complete paraplegia 19% incomplete paraplegia 23% complete tetraplegia 21% incomplete tetraplegia 49% single	Mailed questionnaire	Not defined	44%
Decker and Schulz (1985) United States	100 people with SCI living in the community. Sample had to be >40 years of age, 5 years after injury, and have no progressive deteriorating disease. 90% male 100% white Mean age = 56 years 40% incomplete paraplegia 27% complete paraplegia 29% incomplete tetraplegia 4% complete tetraplegia	Interviews conducted by psychiatric nurses	Not defined	36%

Table 1. Continued

Study/Location	Sample Characteristics	Method of Obtaining Data	Definition of Employment	Employment Rate
DeVivo et al (1987) United States	154 persons receiving rehabilitation at a SCI facility from 1973 to 1979 and followed 7 years after injury Demographics at time of injury: Mean age = 28.4 years 77% male 61% white 32% married 38% HS grads 34% normal IQ 44% tetraplegia	Data abstracted from hospital records and interviews with vocational rehabilitation counselor before initial hospital discharge and annually thereafter	Study population was divided into 4 groups: (a) persons continuously unemployed after injury, (b) homemakers, (c) students, and (d) those employed at some time during the 7-year follow-up period. Persons qualifying for >1 group were assigned to the highest numbered group for which they were eligible.	Approximately 3% were employed 1 year after injury, whereas approximately 19% were employed either full- or part-time by year 7.
DeVivo et al (1991) United States	NSCISC database containing information collected prospectively on 13,763 persons injured since 1973 and treated at model systems throughout the US Mean age = 30.5 years 82.3% male 71.1% white 54.2% tetraplegia 55.6% ≥ HS education	Information is submitted on standardized forms in accordance with a detailed set of instructions	Of the sample, only persons age 16 to 59 years with known employment status were included in the analysis of employment rates (n = 6,862). Defined as being employed in competitive labor market.	12.6% 2 years after injury to 38.3% 12 years after injury
Dew et al (1983) ^a United States	111 persons from the SCI population served by the West Roxbury VA, Boston, MA 99% male Mean age = 44.6 years 73% HS education 51% married 58% paraplegia 36% injured >10 years before interview	Structured interview questionnaire in person	“Current employment” broken down to number of hours worked per week by employed patients: ≥41 = 18% 26–40 = 23% 11–25 = 18% ≤10 = 41%	20%
Deyoe (1972) ^a United States	219 veterans with SCI who had previously been treated in comprehensive rehabilitation programs at VA hospitals and had been living at home for period up to 25 years 31% tetraplegia Age range 21–75 years Years of paralysis: 2 to 30+	Face-to-face interviews	“Gainfully employed”	28% gainfully employed at time of study 30% previously worked but were not employed at time of study

Table 1. Continued

Study/Location	Sample Characteristics	Method of Obtaining Data	Definition of Employment	Employment Rate
Drewes et al (1989) Denmark	58 patients treated for traumatic SCI (1980–1984) Patients were excluded if they recovered to pre-injury functional status, concomitant brain lesion, or progressive disease Median age was 20 years Male:female ratio was 2.6:1 71% paraplegia	Review of medical records conducted in 1988; patients were interviewed if data were missing or if there were discrepancies	Not defined	79% were employed at the time of injury 28% were employed at follow-up (4–8 years after treatment)
El Ghatit and Hanson (1978) ^a United States	760 veterans who had attended a SCI VA facility in California Median time since injury = 12 years Median age at injury = 25 100% male 44% married at time of injury 63% married at time of survey 38% post-HS education	Mailed questionnaires	Not defined	23.5% were employed at time of survey 12% worked part-time 38% worked fulltime
Fiedler et al (2002) United States	97 individuals residing in Midwestern United States who had been treated at the Model SCI System Center during their post-injury period. All had sustained an SCI resulting in permanent physical deficits and were at least 1 year after injury. 82% male 63% white 53% single Mean age = 38.8 years Mean time since injury = 6.6 years 19% complete tetraplegia 20% incomplete tetraplegia 35% complete paraplegia 26% incomplete paraplegia	Face-to-face, in-home, interview	Definition used by Social Security Administration: “performance of significant, productive physical or mental work for pay or profit”	33%
Franceschini et al (2003) Italy	146 patients with SCI discharged after first hospitalization from rehabilitation facilities from 1989 to 1994 71% male Mean age = 37.8 years Mean interval from discharge = 6.1 years 75% of injuries were of traumatic onset	Questionnaire administered by telephone	Employed	29.50%

Table 1. Continued

Study/Location	Sample Characteristics	Method of Obtaining Data	Definition of Employment	Employment Rate
Fuhrer et al (1987) United States	34 quadriplegics who were ventilator-dependent upon discharge from inpatient rehabilitation and 196 persons who had required mechanical respiration some time during rehabilitation but were free of such at discharge. Assessed 1 year after injury. Ventilator-dependent group: Mean age = 25.2 years 79% male Ventilator-independent group: Mean age = 25.9 years 85% male	Data were obtained from the NSCISC Database	Working in competitive labor market	4% Ventilator-dependent group 2% ventilator-independent group 1 year after discharge
Hess et al (2000) United States	Prospectively collected data from 1986 through 1995, submitted to NSCISC Individuals were evaluated at discharge from rehabilitation and at 1, 2, and 3 years after injury (sample sizes of 1,857, 1,486, and 1,177, respectively). Eligibility criteria and characteristics for persons enrolled in the NSCISC database include (a) sustaining an SCI by traumatic etiology; (b) receiving treatment at a model SCI system within 60 days of injury; and (c) having had a clinically discernible degree of spinal cord neurologic impairment on admission. The initial study population drawn from the database consisted of 3,175 individuals, 18–65 years of age, who were employed at the time of SCI.	Analysis of prospectively collected data	Defined by the NSCISC database as individuals legally and gainfully working in the competitive labor market	21% employed at year 1, 21% employed at year 2, 23% employed at year 3
Jang et al (2005) Taiwan	169 persons with traumatic SCI who had been completely rehabilitated in a university hospital 1989–2002. 87% male Mean age at interview = 39 years Mean age at injury = 29 years Mean time since injury = 11 years	Self-administered questionnaire in person	Remunerative employment	47%

Table 1. Continued

Study/Location	Sample Characteristics	Method of Obtaining Data	Definition of Employment	Employment Rate
Krause (1990) United States	344 persons with traumatic SCI in Minnesota. Participants had been injured at least 2 years before the time of the survey. 80% males Mean age = 39 years Mean age at onset of injury = 24 years Mean time since injury = 14 years 57% tetraplegia 47% single	Mailed questionnaire	Persons were either classified as (a) working, (b) students, (c) volunteer, (d) homemaker, or (e) unemployed. Persons who were engaged in >1 productive activity were classified at the highest applicable level of the hierarchy. Students, volunteers, and homemakers were later combined into a single productivity group.	45% in paid employment or self-employed at 2 years
Krause (1992) United States	286 patients injured at least 6 years prior to the study who received outpatient services from a urologic clinic at a Midwestern university hospital before 1985 Mean age at time of study = 41.9 years Mean age at time of injury = 23.4 years Mean age since time of injury = 18.6 years 81% males 45% single 61% tetraplegia	Mailed questionnaire	Not defined	48% working at the time of the follow-up study; approximately 75% had worked at some point since injury.
Krause (1992) United States	286 former patients of an outpatient clinic at a large Midwestern university hospital who had traumatic SCI Mean age at time of injury = 23.4 years Mean age at time of study = 41.9 years 81% male 61% tetraplegia Mean time since injury = 18.6 years 45% single, 41% married	Mailed questionnaire	Participants were classified into 1 of 3 groups: currently employed (n = 137); currently unemployed, but employed at some time since injury (n = 74); and never employed since injury	48% currently employed; 74% employed at some point since injury

Table 1. Continued

Study/Location	Sample Characteristics	Method of Obtaining Data	Definition of Employment	Employment Rate
Krause (1996) United States	142 former patients of an outpatient clinic at a large Midwestern university hospital who had traumatic SCI and who were a minimum of 2 years after injury. Participants were involved in a similar study 11 years earlier. Participants aged ≥ 60 years were eliminated. Mean age at time of study = 40.5 years Mean age at time of injury = 20.5 years Mean time passed since injury = 20.0 years 82% males 66% tetraplegia 47% married 37% single	Mailed questionnaire	Participants were classified into 4 groups based on a cross-tabulation of employment status at the 2 times of measurement. These groups included (a) employed on both occasions, unemployment (stable employment), (b) employed at time 1, but unemployed at time 2 (negative transition), (c) unemployed at time 1, but employed at time 2, (positive transition), and (d) unemployed on both occasions (chronic unemployment).	33% stable employment; 22% positive transition group; 11% negative transition group; 35% chronic unemployment group
Krause and Anson (1996) United States	362 persons with SCI, selected by stratified sampling according to gender, race, and age. Participants were further grouped into cohorts based on time since injury, injury severity, and years of education. Mean age at time of study = 39 years Mean time passed since injury = 6 years 57% males 53% tetraplegia Mean education level = 12.2 years	Multidimensional Adjustment Profile (MAP)	Not defined	25% employed at time of study; 35% had been employed at some time since injury
Krause (1997) United States	235 former patients of an outpatient clinic at a large Midwestern university hospital who had traumatic SCI and who had participated in the same survey in 1985. Mean age at time of study = 40.7 years Mean age at time of injury = 23.1 years Mean time passed since injury = 23.6 years 83% male 62% tetraplegia 46% married	Mailed questionnaire	Gainfully employed	54.70%

Table 1. Continued

Study/Location	Sample Characteristics	Method of Obtaining Data	Definition of Employment	Employment Rate
Krause (2003) United States	259 persons with traumatic SCI who were a minimum of 2 years after injury, and had been employed at the time of the SCI. 82% male 97% white 56% cervical Mean age at time of study = 46.5 years Mean age at time of injury = 22.9 years Mean time passed since injury = 23.7 years	Mailed questionnaire	Not defined	71%
Krause and Broderick (2005) United States	256 patients with SCI who had received renal function services at a large Midwestern university hospital prior to 1974 comprised the initial participant pool. Participants met the following 3 screening criteria: (a) traumatic SCI, (b) ≥ 18 years of age, and (c) a minimum of 2 years after injury. Follow-up data were collected 25 years later from 95 available respondents. Mean age at time of study = 53.8 years Mean time since injury = 32.2 years 83% males 70.5% tetraplegia 100% white	Mailed questionnaire	Employment was defined as 'working for pay' and was assessed by the number of hours per week an individual spent working and the number of years at their current job.	51% were working 25 years after initial study
Krause and Broderick (2006) United States	1,139 individuals who were ≥ 18 years of age, had a traumatic SCI, and were injured for at least 1 year 74% male 75% White Mean age at time of study = 41.6 years Mean time passed since injury = 9.7 years 55% tetraplegia	Mailed survey questionnaire	Not defined	27% currently employed 44% employed at some point since SCI onset

Table 1. Continued

Study/Location	Sample Characteristics	Method of Obtaining Data	Definition of Employment	Employment Rate
Krause and Crewe (1987) United States	Examined responses of 256 persons with SCI who completed a survey in 1974 with responses of those persons who survived their injuries (n = 179) with those who had died (n = 46) by 1985. All had traumatic injuries, had been injured at least 2 years before, and had participated in the Renal Function Studies program at the University of Minnesota Hospital 82% male Mean age at time of study = 35.1 years Mean age at time of injury = 25.2 years 51% single 54% cervical lesions	Mailed questionnaire	Not defined	41%
Krause and Terza (2006) United States	615 adults with traumatic SCI of at least 2-year duration and under the traditional retirement age of 65. Mean age at time of study = 43 years Mean age at time of injury = 25.2 years Mean time passed since injury = 17.8 years 67% male 80% white 56% cervical-level injuries 72% were working at time of injury	Mailed questionnaire	“What is your annual income from your salary only (if you are working)?”	43%
Krause et al (1998) United States	1,032 individuals with SCI: 597 from the Southeast and 435 from the Midwest. The 2 subsamples were selected from outpatient files at a rehabilitation hospital in the Southeast (n = 597) and a rehabilitation hospital in the Midwest (n = 435). The Southeastern sample was selected using stratified sampling of a larger outpatient participant pool (based on sex, race/ethnicity, and chronologic age), whereas all possible cases meeting the criteria were selected from the Midwestern sample. Participants met 3 screening criteria: (a) traumatic SCI, (b) \geq age 18 years, and (c) a minimum of 2 years after injury.	Mailed questionnaire	Employment was defined as ‘working for pay’ (ie, salary, wages, or self-employment)	36% working at time of study; 56% had worked at some time since the injury Current employment rates ranged from 21% to 58% for Midwestern participants, but only from 5% to 32% for Southeastern participants Rates of employment since injury ranged from 48% to 68% for the Midwestern sample, compared with 21% to 54% for the Southeastern sample

Table 1. Continued

Study/Location	Sample Characteristics	Method of Obtaining Data	Definition of Employment	Employment Rate
	Mean age at time of study = 42.4 years Mean age at time of injury = 29 years Mean time passed since injury = 13.4 years 64% male 75% white 55% tetraplegia 72% were working at time of injury			
McAdam and Natvig (1980) Norway	16-year follow-up of 61 persons with complete paraplegia (T1–T3 levels) seen at the State Rehabilitation Institute in Oslo, Norway Mean time passed since injury = 11.6 years 90% male; 100% paraplegia	Mailed questionnaire and follow-up phone contact if necessary	“Working for a living”	59% working full-time and 10% part-time
McShane and Karp (1993) Canada	120 former patients of a rehabilitation center in British Columbia, Canada who had experienced traumatic SCI 3 and 10 years prior to the study, were 18 to 60 years of age at the time of injury, and were <65 years of age at the time of the study. Mean age at time of study = 36 years Mean age at time of injury = 29 years 54% had C1–C8 lesions 66% had postsecondary education	Mailed questionnaire	Whether the person participated in paid employment during the 6 months before the data were collected	42%
Meade et al (2004) United States	Retrospective analysis performed on cross-sectional data from 5,925 individuals in the NSCISC from 1972 to 2002. 162 individuals were followed 20 years after injury 82% male 32% incomplete tetraplegia	In-person or telephone interviews, mail surveys, and/or chart reviews	Paid employment	11.9 working 1 year after injury 18.7% working 5 years after injury 22% working 10 years after injury 22.2% working 15 years after injury 22.9% working 20 years after injury
Meade et al (2006) United States	Retrospective analysis performed on cross-sectional data from 436 individuals from age 18 to 64 years that participated in the quantitative component of a larger project examining the needs of Virginians with SCI Mean age at time of study = 43.8 years Mean age at time of injury = 10.8 years	Survey that was completed in written format, via internet, or via telephone	Fulltime employment = working ≥ 30 h/wk; part-time employment = working <30 h/w	34% employed full-time; 8% employed part-time

Table 1. Continued

Study/Location	Sample Characteristics	Method of Obtaining Data	Definition of Employment	Employment Rate
Murphy et al (1997) Australia	219 hospital patients with SCI in Melbourne, Australia Mean age at time of study = 42.56 years Mean time passed since injury = 12.45 years 76% had not completed HS 83% male 66% had been working fulltime at the time of their injury	Self-administered survey handed out by nurses	Employed or actively looking for work Work rate also used to as a measure of employment durability	26% worked full time at time of study; 11% worked part time
Murphy and Athanasou (1994) Australia	Review of 17 published studies published (1976–1991) 3,568 subjects participated in the 17 studies 56% paraplegia 44% tetraplegia	Review of 24 studies	Not defined	40.3% returned to work after injury
Murphy et al (2003) Australia	459 persons with traumatic SCI who were at least 18 mo postinjury and had been admitted to a spinal unit and discharged with persistent neurologic damage Mean age at time of study = 39.6 years Mean age at time of injury = 28.4 years Mean time since injury = 11.2 years 85% male 47% paraplegia 81% were employed pre-injury	Self-report survey	Not defined	47%
Pflaum et al (2006) United States	20,143 persons enrolled in the NSCISC database SCI caused by a traumatic event Subset of persons 18–65 years of age with normal neurologic status, excluding students and the incarcerated, from 1976 to 1981 Mean age = 37 years 82% male 72% white, 19% African American, 9% other 38% married, 37% single/never married Mean years since injury = 4 61% HS education, 15% Bachelors degree	Health, sociologic, and economic data obtained at face-to-face initial hospital evaluations and annual evaluations	Self-reported employment status at time of annual evaluation. Coded as: Competitive labor market, homemaker, on-the-job-training, sheltered workshop, student, retired, or unemployed	Overall employment rate was about 36% (which peaked at age 27 years)
Richards (1982) Australia	166 persons who had rehabilitated in Queensland, Australia from 1975 to 1980 75% men 45% tetraplegia	Written questionnaire	Employed	21% employed after injury

Table 1. Continued

Study/Location	Sample Characteristics	Method of Obtaining Data	Definition of Employment	Employment Rate
Schonherr et al (2004) The Netherlands	57 persons with acute traumatic SCI who were consecutively admitted to a Dutch rehab center from 1990 to 1998 Mean age at SCI = 33 years 91% male Mean months since SCI = 84 Age range = 18–59 years	Mailed questionnaire	Successful return to a paid job by those who were employed preinjury	67% of respondents who were employed pre-injury returned to work 31% working had a paid job without supplementary benefits and 69% worked with benefit from the Work Disability Act
Schonherr et al (2005) The Netherlands	57 persons with acute traumatic SCI who were consecutively admitted to a Dutch rehab center from 1990 to 1998 and living in community at time of study M age at time of injury = 33 years Mean months since SCI = 84 91% male	Mailed questionnaire	Paid work	67% of respondents who were employed pre-injury returned to work
Schonherr et al (2005) The Netherlands	57 persons with acute traumatic SCI who were consecutively admitted to a Dutch rehab center from 1990 to 1998 and living in community at time of study. M age at time of injury = 33 years Mean months since SCI = 84 91% male	Mailed questionnaire	Paid work for at least 4 h/wk	60% of respondents who were employed before injury returned to work
Selecki et al (1986) Australia	Retrospective study of 133 survivors of acute and severe SCI who were treated in hospitals in New South Wales 1977–1978	Review of hospital records	“Resumed work”	11%
Siosteen (1990) Sweden	56 patients who had been treated at a spinal unit in Sweden who were living in the community. None had suffered serious head injuries. Median age at time of study = 32 years Median age at time of injury = 27 years 82% males 73% paraplegia 27% tetraplegia	Face-to-face exam and questionnaire	Not defined	80% reported but that included 48% who were working and 32% who were in school

Table 1. Continued

Study/Location	Sample Characteristics	Method of Obtaining Data	Definition of Employment	Employment Rate
Tasiemski et al (2000) United Kingdom	45 subjects who had SCI at level C5 or below, were wheelchair dependent, from age 18 to 50 years at time of injury, injured at least 10 years ago, and were admitted to treatment within 6 months of injury 80% male 46.7% tetraplegia	Mailed questionnaire	Not defined	33%
Tomassen et al (2000) The Netherlands	234 persons with SCI who were gainfully employed at the time of injury and underwent a rehabilitation program in a specialized rehabilitation center in the Netherlands from 1986 to 1992 Mean age at time of study = 40 years Majority were male Mean years since injury = 4.5 years	Face-to-face interview at home	Gainfully employed	37%; of which 33% returned to same job
Valtonen et al (2006) Sweden	182 persons ages 18 to 65 who had sustained traumatic SCI at least 2 years earlier and who were treated in a Spinal Injuries Unit 74% males Mean age at time of study = 44.7 years Mean age at time of injury = 30.5 years 47% cervical	Mailed questionnaire	Participating in work (fulltime employment, part-time employment, entrepreneurs, fulltime students)	47%
Ville and Ravaud (1996) France	277 persons with SCI dating back at least 3 years who had virtually permanent use of wheelchair and/or crutches and who were integrated into the community in France Students and retirees were excluded Mean age at time of study = 41.5 years 63% males 90% paraplegia 10% tetraplegia	Mailed questionnaire after telephone contact	Not defined	36%

Table 1. Continued

Study/Location	Sample Characteristics	Method of Obtaining Data	Definition of Employment	Employment Rate
Weidman and Freehafer (1981) United States	145 persons treated at a SCI facility in Ohio 77% male Mean age at time of study = 36 years for males Mean age at time of study = 34 years for females Mean age at time of study = 34 years for females Mean age at time of injury = 31 years for males Mean age at time of injury = 28 years for females Mean time since injury = 6 years 54% tetraplegia 46% paraplegia	Mailed questionnaire and interviewed	Vocational mode included students, homemakers, full time and part time employment	48% "Positive vocation mode" 21% employed outside of home (not including students and homemakers)
Yavuzer and Ergin (2002) Turkey	70 individuals who sustained SCI with resultant paraplegia or tetraplegia and participated in inpatient rehabilitation at a medical school in Turkey 56% male Age at the time of injury ranged from 16 to 54 years. Age at the time of study ranged from 17 to 58 years; median follow-up time was 30 months (range, 13–72 months).	Medical records review and phone interview	Working in a job for which they got paid, school and volunteer activities	36% of those who were employed prior to SCI returned to work (either same job or new job)
Yerxa and Baum (1986) United States	15 community-based people with SCI were compared with 12 age- and sex-matched cohorts. Mean age at time of study = 38 years 67% male 27% paraplegia 73% tetraplegia Mean time after onset = 15.6 years	Mailed questionnaire	Employed	33%
Young and Alfred (1994) ^a United States	Random sample of 140 persons with SCI living in the community in Texas. Persons had SCI sustained at least 9 months previously and had residual motor disability at least severe enough to require use of an assistive device for walking. Mean age at time of study = 37 years Mean age at time of injury = 26 years Mean time since injury = 11 years 71% male	Questionnaires, home interview, and physical examination conducted at a rehabilitation hospital	Paid employment (part time or full time)	27% (19% full time)

Table 1. Continued

Study/Location	Sample Characteristics	Method of Obtaining Data	Definition of Employment	Employment Rate
	68% white 29% HS education 37% some college 16% veterans			
Young and Murphy (2002) Australia	170 persons treated at SCI center for traumatic SCI and who had been employed before injury 88% male 53% tetraplegia Mean age at time of study = 36.8 years	Face-to-face interview	Paid employment (working at least 1 h/wk)	48%
Young et al (2004) Australia	192 individuals with traumatic SCI who were employed at time of their injury A consecutive sampling technique based on new admissions to spinal units in Australia (1990–1996) 88% male Mean age at time of study = 39.5 years Mean age at time of injury = 34.9 years Mean time since injury = 4.3 years 51% tetraplegia	Review of hospital records, interview by phone or in person	Employed in paid work	46% employed at time of assessment

^aVeteran studies

NSCISC, National Spinal Cord Injury Center Statistical Center

Characteristics Associated With Returning to Work

A review of the literature indicates that 11 key factors are associated with employability among persons with SCI (43). These include education, type of employment, disability severity, age, time since injury, sex, marital status and social support, vocational counseling, medical problems related to SCI, employer role, environment, and professional interests. Educational attainment is perhaps the strongest predictor of return to work for persons with SCI (1,2,44–46). Persons with college level educational backgrounds are most likely to return to work (3,21), whereas those with less than 12 years of education are at a disadvantage (20). One study showed re-employment rates of 95% for persons with SCI who had 16 or greater years of education (24). Obtaining further education or retraining after SCI has also been associated with a greater likelihood of employment (3,47) and availability of a wider range of occupations for which individuals were qualified (1). It has been suggested that higher levels of education may be related

to increased employability because of higher level of education being associated with higher social economic status and increased employment options (1). Those with higher levels of education are less likely to obtain manual labor jobs, which favors their potential to return to work in cases where SCI is involved. Other reasons cited for higher education being associated with better rates of returning to work after SCI include those with high education (a) require less change in their occupation, (b) may have more autonomy and motivation, and (c) have more positive personal expectations (43).

Many researchers have found that age of onset of SCI significantly relates to return to work after SCI (12,19,48,49). Being younger at the time of injury is associated with the best employment outcomes, with poorer employment outcomes found as age of onset increases (20,24). Having a greater number of years living with a SCI is also associated with more positive employment outcomes (1,2,8,20,24). It is reported that the probability of employment after SCI improves with increasing time since injury (20,21). Persons who incur

their SCI at an older age are much less likely than younger persons to return to work (44). Furthermore, persons injured during adulthood have lower reported employment rates and physical functioning vs those injured in childhood (50). A 25-year cross-sectional study of employment and aging in persons with SCI showed that rates of employment increased over time, and as rates increased, levels of satisfaction with employment did as well (51). A curvilinear relationship has been found regarding age and amount of time spent working, with number of hours per week peaking from age 36 to 45 years (52). However, there is evidence to suggest that, as persons approach retirement age, employment may terminate prematurely among persons with SCI, with people retiring in the 51- to 60-year age range rather than the traditional over-60 range (53).

Race has also been associated with obtaining employment after SCI. Whites have been found more likely to be employed than minorities. Several studies (1,2,8,12,45,54,55) suggested that individuals with SCI from minority backgrounds are disadvantaged in terms of return to gainful employment, with this racial disparity mirroring patterns found among the general population. This difference persists even when controlling for educational level (8).

The influence of sex on obtaining employment has shown mixed results. In many cases, men have been found more likely to return to work (3,56–60), whereas in some cases, women have been found more likely to be employed after SCI (2,44,49). When type of work is considered, it has been found that men are more likely to return to competitive (paid) employment, whereas women are more likely to be engaged in nonpaid, productive roles (eg, homemaker) (61). However, in a large sample of individuals with SCI in 2 regions of the United States, sex was not predictive of employment status based on logistic regression analyses (8). Interestingly, employment was defined in this study as “working for pay,” which excluded homemakers and students.

Although many studies have found an association between severity of injury and employment (12,45,47,57,61–63), others have not (5,8,20,64,65). One study found that considering the functional interaction between level of injury and degree of completeness enhances the ability to predict return to work (1), with those individuals who had greater physical abilities being more likely to be employed.

About 40% of persons with paraplegia and 30% of persons with tetraplegia eventually return to work (33). The odds of participants with paraplegia being currently employed were 2.0 to 2.2 times higher and the odds of having been employed at some time since injury were 3.5 to 5.3 times higher than for participants with tetraplegia (8). Veterans with paraplegia are reported to be more likely to return to work compared with those with tetraplegia, but persons with tetraplegia are equally as likely to sustain employment once achieved (19,47). In

a study examining only persons with tetraplegia and comparing vocational status in those who were ventilator dependent on discharge from inpatient rehabilitation and those who had required mechanical respiration some time during rehabilitation but were free of such at discharge, less than 5% of each group were employed in the competitive labor market 1 year after injury (66). The somewhat greater autonomy of the ventilator-independent group did not translate into different vocational outcomes, because both groups had similar unemployment rates. In a study by Krause (20), those with paraplegia were more likely to return to their preinjury jobs and worked more total years since injury than those with tetraplegia. It was suggested that it may take longer for those with tetraplegia to return to work. Therefore, examination of employment rates over a length of time since injury may be important to capture a comparable outcome for individuals with tetraplegia. The reader is referred to Table 2 for summary of studies citing characteristics related to returning to work after SCI.

Benefits of Returning to Work

Benefits of employment after SCI are multiple and well documented in the literature, with productivity and employment being consistently associated with life satisfaction, quality of life, and adjustment. Among persons with chronic SCI living in the community, money matters and employment are among the life domains with the lowest satisfaction ratings (67). Although life satisfaction has been reported to be lower in persons with SCI overall, it is relatively greater in those individuals involved in productive activities such as work (68). In fact, among employed individuals, there is not a significant difference in quality-of-life ratings between persons with SCI and persons without SCI. Employment is more related to satisfaction with life than level of impairment or disability itself (21). Among persons with SCI, those who are employed evidence significantly better psychologic adjustment than those who are unemployed (5,24). Furthermore, evidence strongly suggests that there is a directional influence between employment and adjustment. As persons with SCI transition from unemployment to employment, adjustment increases, and if they transition from employment to unemployment, adjustment decreases (5). Related benefits of employment among persons with SCI include higher activity levels and less medical treatments (5). Reports from qualitative data cite several perceived advantages of returning to work after SCI, including mental stimulation, social contact, a sense of purpose, and personal growth (42). Given these data (2,25), it is crucial to address vocational goals in rehabilitation, because employment seems to have a “spread effect” where it enhances many areas of life adjustment. Although this body of research does not establish causality, a likely path is that characteristics that are

established as known predictors, such as education, increases the probability of employment, which in turn is associated with many life rewards such as improved quality of life and well being.

Although not specific to those with SCI, quality of life has been shown to be greater for individuals who are employed vs those who remain unemployed, but the persistence of overall quality-of-life spilling over into an individual's satisfaction with work and accomplishment of long-range vocational goals is correlated with the intensity of supported vocational rehabilitation the individual receives (69). Most quantitative studies evaluating vocational rehabilitation programs fail to consistently distinguish any significant differences in nonemployment factors, such as sustaining care needs or level of handicap, among individuals participating in different vocational rehabilitation programs or individuals who receive no vocational rehabilitation (70). Although participation in vocational rehabilitation does not seem to have any effect on social changes, sustaining care needs, or overall lifestyles of participants, evidence does abound in the literature substantiating the positive benefits correlated with return to work for persons with disabilities. Although type and length of disability may be conversely related to employment ratios in populations of persons with severe disabilities, the individual's type or severity of disability does not seem to affect employment successes after vocational rehabilitation (69).

Barriers to Returning to Work

The perception of barriers associated with employment differs between employed and unemployed persons with SCI. It has been found that, although employed persons with SCI tend to not perceive significant barriers to employment (11), 25% of individuals perceived lack of transportation and lack of Social Security benefits as the main barriers. For persons with SCI who were unemployed, 64% indicated lack of transportation, whereas 48% indicated having no time off for health-related concerns as being main perceived barriers to employment (11). Having reliable transportation, especially being able to drive oneself, has been identified in numerous studies as one factor related to returning to work (18,19,71,72). Difficulty accessing healthcare has also been related to higher unemployment or part-time employment (55). An additional barrier facing persons with disabilities for return to work is the perceived biases held by employers and others in the workforce about the capabilities of persons with disabilities (73–77). Poor physical health, physical limitations, and frequent hospitalizations have been reported by some as being associated with unemployment (19,26,30,48,78–80). A reluctance to return to work for fear of losing financial and/or medical benefits has also been reported (26,72,81,82). Level of injury (12,45,47,57–59,61–63) and having greater functional ability (1,3,12,49,56,61)

have also been associated with returning to work among individuals with SCI. Additional factors such as low level of income, high cost of medical equipment and supplies, chronic pain, and perceived poor attitude of rehabilitation professionals have also been noted as barriers reported by those with SCI (78). Veterans with SCI listed various reasons for lack of employment including inability to sit for long hours, inability to find a suitable job, frequent grounding at home, retirement because of disability, frequent hospital admissions, fear of losing disability benefits, and fear of not being hired because of handicap (19).

Survey data indicate that many persons with SCI received little to no information during their rehabilitation about employment support and resources that are available to them (83). When asked what would improve services in this area, survey respondents listed (a) more provider training about SCI-specific issues, (b) increased communication between provider and patient/family, and (c) increased flexibility and availability of services to ensure access to necessary care (83). Clearly, maintaining adequate healthcare, a mechanism to understand and evaluate the impact of work on disability benefits, and accessing and understanding vocational services are all necessary and essential services that need to be included in rehabilitation after SCI to address vocational barriers.

Chronological age and associated factors have been found to be related to barriers to employment. In a study that examined age cohorts of their sample, those in the older cohorts had a less optimistic view of returning to work and those in the oldest cohort (55–64 years) reported that they were retired despite being younger than the retirement rate for their non-SCI-injured peers (84). In fact, the hope of returning to work declines with each decade lived after SCI. The overall likelihood of maintaining hope to return to work declines in those individuals who remain unemployed after the first decade of onset of SCI injury (45). In addition, 4 times as many individuals in the oldest cohort reported they were not physically capable of working compared to the younger cohorts. Older age of onset of injury has also been found to be associated with additional barriers to employment, such as requiring additional support and decreased energy (84). Interestingly, chronological age and age at injury onset have shown to also be influenced by sex, whereas nonparticipation in work was increased for men who were older than 55 and also in men who sustained an injury past the age of 40.

Vocational Rehabilitation Services

Most vocational rehabilitation programs reported in the literature are tailored to the needs of persons with mental illness, drug or alcohol abuse, brain injury, mental retardation, or workers' compensation injuries. The design of reported vocational rehabilitation programs for these populations of individuals disabled from work because of cognitive or mental impairments may not

Table 2. Characteristics Associated With Returning to Work After SCI

Characteristic	Studies Citing Characteristics
Age at time of injury/study	Benavente et al (2003); Cook et al (1981); DeJong et al (1984); DeVivo and Fine (1982); DeVivo et al (1992); DeVivo et al (1991); DeVivo et al (1987); El Ghatit and Hanson (1978); Hess et al (2000); Krause (1992a); Krause (1992b); Krause (1996); Krause (2001); Krause 2003; Krause and Anson (1996); Krause and Broderick (2006); Krause et al (1999); Krause et al (1998); Krause and Terza (2006); Meade et al (2006); Pflaum et al (2006); Tomassen et al (2000); Ville and Ravaud (1996); Valtonen et al (2006); Yasuda et al (2002); Young and Murphy (2002)
Educational level	Alfred et al (1987); Anderson and Vogel (2002); Anderson et al (2004); Anderson et al (2006); Benavente et al (2003); Crisp (1981); Crisp (1990); Conroy and McKenna (1999); DeJong et al (1984); DeVivo et al (1991); DeVivo et al (1987); El Ghatit and Hanson (1978); El Ghatit and Hanson (1979); Hess et al (2000); Jang et al (2005); Krause (1990); Krause (1992a); Krause (1992b); Krause (1996); Krause 2003; Krause and Anson (1996); Krause and Broderick (2006); Krause and Terza (1996); Krause et al (1999); Krause and Terza (2006); McShane and Karp (1993); Meade et al (2006); Murphy et al (1997); Pflaum et al (2006); Schonherr et al (2005); Tomassen et al (2000); Ville and Ravaud (1996); Valtonen and Karlsson (2006); Yasuda et al (2002); Young and Alfred (1994)
Being employed at time of injury or before injury	DeVivo and Fine (1982); DeVivo et al (1991); Pflaum et al (2006)
Being able to drive/transportation	Brown et al (1987); DeJong et al (1984); El Ghatit and Hanson (1978); Fiedler et al (2002); McShane and Karp (1993)
Sex	Anderson et al (2006); DeVivo and Fine (1982); DeVivo et al (1991); James et al (1992); Krause and Anson (1996); Krause and Terza (2006); Meade et al (2004); Tomassen et al (2000); Valtonen et al (2006); Ville and Ravaud (1996); Yasuda et al (2002); Young and Alfred (1994)
Physical health	Anderson et al (2004); Anderson et al (2006); Chapin and Kewman (2001); Meade et al (2006)
Greater functional ability	Anderson and Vogel (2002); Anderson et al (2004); Anderson et al (2006); Benavente et al (2003); DeVivo and Fine (1982); DeVivo et al (1991); DeVivo et al (1987); Hess et al (2000); Jang et al (2005); Meade et al (2006); Tomassen et al (2000); Young and Alfred (1994)
Severity of injury/level of injury	Benavente et al (2003); El Ghatit and Hanson (1979); DeVivo et al (1987); Krause et al (1999); Krause 2003; Krause and Broderick (2006); Krause and Terza (2006); Pflaum et al (2006); Ville and Ravaud (1996); Valtonen and Karlsson (2006); Wang et al (2002); Young and Alfred (1994)
Life satisfaction	Anderson et al (2006); Decker and Schulz (1985); Krause (1990)
Locus of control	Krause and Broderick (2006)
Motivational level/expectation to work	Chapin and Kewman (2001); DeVivo et al (1991); DeVivo et al (1987); McShane and Karp (1993); Schonherr et al (2004)
Race	Anderson et al (2006); DeVivo and Fine (1982); DeVivo et al (1991); Hess et al (2000); Krause and Anson (1996); Krause and Broderick (2006); Krause and Terza (1996); Meade et al (2004); Meade et al (2006); Murphy and Young (2005); Pflaum et al (2006); Yasuda et al (2002); Young and Alfred (1994)

Table 2. Continued

Characteristic	Studies Citing Characteristics
Paraplegia rather than tetraplegia	El Ghatit and Hanson (1978); Krause (1992a); Krause and Anson (1996); Krause and Terza (1996); Krause et al (1998); Pflaum et al (2006); Noreau and Shephard (1992); Wang et al (2002)
Being married	El Ghatit and Hanson (1978); Hess et al (2000); Jang et al (2005); Pflaum et al (2006)
Time since injury	Crewe and Krause, 1990; El Ghatit and Hanson (1978); Krause (1992a); Krause (1992b); Krause (1996); Krause and Anson (1996); Krause and Broderick (2006); Murphy et al (1997); Pflaum et al (2006); Valtonen et al (2006); Yasuda et al (2002)
Support	DeVivo et al (1987); Fiedler et al (2002); Mackenzie et al (1987); McShane and Karp (1993); Fiedler et al (2002); Pflaum, et al (2006); Sherman et al (2004)

readily generalize in terms of the issues faced in overcoming vocational liabilities by persons with severe physical disability such as persons with SCI. Nevertheless, there are some lessons to be learned from extant vocational rehabilitation approaches in terms of program operations, potential outcomes, and systems for program evaluation.

Vocational rehabilitation usually adheres to 1 of 2 frameworks, conventional vocational rehabilitation and supported employment, each with very diverse operational standards and approaches. Conventional vocational rehabilitation approaches usually involve some form of either sheltered workshops or transitional employment experiences. Sheltered workshops represent the earliest form of vocational rehabilitation, where persons with severe disabilities are given tasks to perform in a workshop managed by vocational specialists. Transitional employment programs most often provide core services emphasizing preparing individuals with severe disabilities to obtain and hold competitive jobs, with salaries essentially the same as other jobs in the community. The methods used in transitional employment programs include training in job skills, job readiness counseling and education, placement in potentially permanent jobs, and postplacement support/follow-up by vocational counselors to assist the client to become reoriented to being gainfully employed and fitting in with the work force (85).

The supported employment (SE) approach emphasizes competitive employment as the goal, rapid job search, individualized job finding, and continuous follow-along supports after employment (86–89). It began in the field of developmental disabilities (90) and was subsequently modified and adapted for persons with mental illness (91). It has been identified as an evidence-based strategy for people with severe mental illness according a well-specified model (92). The SE approach

has been successfully used to promote return to work for persons with psychiatric illnesses and brain injuries and has strong empirical support (93). Several different supported employment models exist, including the Individual Placement and Support (IPS) model (94), Program of Assertiveness Community Treatment (95), Family-Aided Assertiveness Community Treatment (96), Employer Consortium (97), and Employment Assistance through Reciprocity in Natural Supports (EARNs) (98). Bond et al (99) recently published a comprehensive and rigorous review of randomized controlled trials of high fidelity IPS supported employment and concluded that evidence-based SE is 1 of the most robust interventions available for persons with serious mental illness. It has been reported that from 40% to 60% of people enrolled in SE obtain competitive employment, whereas less than 20% of similar consumers do so when not enrolled in supportive employment (93). Recent data also suggest that the cumulative costs generated by supported employees are much lower than the cumulative costs generated by sheltered employees (100). Despite SE being recognized as an efficacious model and cost-effective model, it has been reported elsewhere that less than 10% of supported employment participants have a physical impairment, such as SCI (101). Although there are no controlled outcome studies to date on vocational rehabilitation after SCI, there are several documented case examples where a supportive employment approach has been used successfully to reduce barriers and return individuals with SCI to work (102–104). Lessons learned from these examples of success emphasize the need for individualized supports to help persons with SCI find employment and the importance of ongoing follow-along services to maintain employment. Targett and Wehman (102) outlined critical characteristics of successful work supports for persons with SCI. These features include real community-based employ-

Table 3. Key Components of Conventional VR Compared With SE

	Conventional VR	SE
Caseload	Typically > 100	No greater than 25
Role of VR counselor	Case manager	Generalist
Timing of services	Sequential; referral to VR after conclusion of care episode	Simultaneous and integrated with other care
Inclusion/exclusion criteria	Often excludes co-occurring conditions	None
Assessment	Formal vocational and/or psychologic testing before services (ie, “train and place” model)	Continuous “on the job” in real world settings (ie, “place and train” model)
Follow-up services	Reduced after specific time period	Indefinite based on client need

VR, vocational rehabilitation; SE, supported employment.

ment, full integration of the person with SCI into the workplace, eligibility of all level of disability for services, job search assistance and on-the-job support, individualized customer-driven services, and personal choice. See Table 3 for a summary of conventional vocational rehabilitation vs supported employment approaches.

VETERANS WITH SCI

Of the more than 250,000 Americans with serious SCIs and disorders, about 42,000 are veterans (105). The Veterans Health Administration (VHA) has the largest and most comprehensive network of SCI care in the nation. It provided a full range of care to nearly 26,000 veterans with SCIs and disorders in 2006 and SCI specialty care to about 13,000 of these veterans (105).

Three studies dated from the 1970s to early 1980s were found that specifically examined employment among veterans. These studies reported employment rates for veterans with SCI ranging from 20% to 28% (19,26,81). These rates are within the typical range of employment rates reported for the general population of persons with SCI (Table 1). A more recent study that focused primarily on assistive technology in the workplace reported significantly different employment rates among veterans with heterogeneous educational backgrounds compared with nonveteran sample of college graduates. Among the veterans in their sample, 18% of veterans and 73% of the nonveterans were currently working, and 70% of the veterans and 8.6% of the nonveterans had not been employed in the last 5 years (106). As in other studies, educational attainment increased the probability of employment. Hence, education more likely than military service history contributed to the varying employment rates. Not only did the groups differ significantly in terms of educational level, but the veterans also reported significantly more medical comorbidities than the nonveterans included in the study. Current studies are needed to determine the current level of unemployment among veterans with SCI compared with the general population of persons with SCI with similar educational backgrounds.

The Department of Veterans Affairs (VA) traditionally has offered veterans an opportunity to return to work

through their compensated work therapy (CWT) program, giving veterans the opportunity to work in sheltered workshops or in transitional employment programs either with community employers or on VA grounds (107,108). In contrast to IPS, CWT has traditionally offered a limited choice of jobs, and until recently, SE was not offered because it did not constitute the statutory definition of medical care as proposed by the VA (109). In 2004, the VHA implemented a large-scale initiative to provide SE to veterans with serious mental illness (SMI) under the auspices of the CWT Programs (110).

Researchers recently published findings regarding the use of the IPS model of supported employment at 9 VA programs and compared client outcomes for homeless veterans with psychiatric or addiction disorders before and after the program was implemented (109). IPS emphasizes rapid job placement, a focus on obtaining competitive jobs chosen by the client, ongoing support without a time limit, and integration of vocational support and clinical care (92). Results of the study suggested that competitive employment days per month over a 2-year follow-up period were 15% higher for veterans in IPS program. This is a smaller effect compared to other studies using IPS (93), and it may be somewhat attributable to methodologic limitations in the study, such as the veterans recruited for IPS had a better long-term work history, had greater employment potential, lower levels of psychiatric symptoms, and a less negative attitude toward work. Another limitation of the study was that 20% of sites did not achieve acceptable model fidelity, suggesting that more intensive onsite training and monitoring may be necessary to optimize dissemination of IPS in veteran samples, where there is a strong tradition of CWT programs.

IMPLICATIONS FOR FUTURE RESEARCH

As a starting point, it is recommended that researchers begin to use common target guidelines when reporting descriptive characteristics of their samples, definition of employment, and accompanying variables of importance. For studies of employment and vocational

Table 4. Recommended Descriptors for Future Research on Employment and SCI

Sample Characteristics	Employment Characteristics
Age at time of injury	Definition of employment used
Age at time of study	Employment status prior to injury
Length of time since injury	Employment status at time of injury
Mental health diagnosis before injury	Employment status since injury
Mental health diagnosis at time of study	Employment status at time of study
Mental health diagnosis since injury	Whether they had worked at any time since injury onset
History of cognitive impairment	No. of hours worked per week at each time point
Physical disability status	Total no. of years employed after injury
Status of compensation seeking	Type of position employed before injury, at time of injury, and after injury
Disability benefits	Duration of employment (no. of weeks worked per year)
	Job tenure (longest job held)
	Wages earned
	Years employed after injury at current position

rehabilitation to be meaningfully interpreted, employment-specific outcome data need to be reported in terms of competitive employment rates, duration of employment, and job tenure (99). See Table 4 for recommended descriptors to be used in SCI research to enable generalizability across studies.

Considering the different methods of vocational rehabilitation studied, evidence-based SE practices seem to most applicable and hold the most promise for assisting persons with SCI restore meaningful employment. SE began in the field of developmental disabilities and was modified for those with mental illness. It is now believed to be one of the most robust interventions available for persons with serious mental illness (99) and has been adapted for populations such as those with an intellectual disability (111), aging adults with schizophrenia (112), bipolar disorders (113), depressive disorders (114), and people with dual disorders (115), and is currently being adapted for populations such as posttraumatic stress disorder, TBIs, and substance abuse problems. Until recently, evidence-based SE had not been widely used or clinically tested among persons with physical disabilities, such as SCI. However, a multisite randomized clinical trial of SE among veterans with SCI is currently underway at 6 VA Medical Centers (116). Research conducted in these various populations will likely lead to population-specific modifications of SE, as has been shown before with individuals with dual mental disorders (115). Efforts directed at adapting evidence-based practices in vocational rehabilitation to effectively meet the needs of persons with SCI and other physical disabilities are critically important to maximize rehabilitation outcomes.

SUMMARY

Employment rates after SCI vary widely depending on several factors, particularly the definition of employment and time of measurement. When only studies that use a strict definition of paid employment are considered, the

average rate of any employment after SCI is approximately 35%. This rate is much lower than the employment rate of 79% reported for persons without disabilities in the United States (117). Characteristics associated with employment after SCI include demographic variables (education, sex, race, marital status), injury-related factors (age at injury, level of injury/impairment/functional status, time since injury), employment history (employment at or before injury), psychosocial issues (transportation, physical health, life satisfaction, locus of control, motivational level/expectation to work, social support), and disability benefit status. Those individuals with SCI who are employed experience significantly better quality of life and life satisfaction among other benefits. However, the barriers to returning to meaningful work can be formidable and numerous, such as inadequate transportation, concerns about benefits or finances, employer biases, and access to healthcare. Vocational rehabilitation programs that address these barriers are essential. To date, the supported employment model of vocational rehabilitation has not yet been widely used or clinically tested among persons with physical disabilities, such as SCI. Although some modifications may be necessary, this approach would seem to hold great promise as an effective method for treating the vocational rehabilitation needs of persons with physical disabilities as well. This area of study needs to be a focus of research efforts to explore, understand, and implement effective programs to improve vocational rehabilitation outcomes among this population of individuals with disabilities.

ACKNOWLEDGMENTS

The authors thank Drs. Lance Goetz and Alina Suris for their thoughtful review and comments. The authors appreciate the technical assistance and support provided by Megan Howard. The authors appreciate the ongoing support of Dr. Lance Goetz and other investigators who

are committed to advancing the understanding of this important line of scientific inquiry.

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